15. (Amended) A vibration type actuator according to Claim 14, wherein said at least one bearing member has one surface facing said fastening member and another surface opposite thereto facing one of said plurality of elastic members .

16. (Amended) A vibration type actuator according to Claim 14, wherein said at least one bearing member can move by a fixed distance along said axial direction.

17. (Amended) A vibration type actuator according to Claim 14, wherein said at least one bearing member can move in the axial direction between one of said plurality of elastic members and said fastening member.

18. (Amended) A vibration type actuator according to Claim 14, wherein a moving distance of said at least one bearing member in the axial direction is restrained by an inner periphery portion of one of said plurality of elastic members and said fastening member.

REMARKS

The claims now pending in the application are Claims 1 to 18, the independent claims being Claims 1 and 14. Claims 1 to 4 and 14 to 18 have been amended.

In the Official Action dated September 16, 2002, the drawings were objected to on formal grounds. Claims 1 to 13 were rejected under 35 U.S.C. § 112,

second paragraph, as indefinite. Claims 1 and 14 were rejected under 35 U.S.C. § 102(b), as anticipated by Japanese Patent Document No. 05-038170, and Claims 10 and 11 were rejected under 35 U.S.C. § 103(a), as unpatentable over the JP '170 reference. Reconsideration and withdrawal of the objection and rejections respectfully are requested in view of the above amendments and the following remarks.

Initially, Applicants gratefully acknowledge the Examiner's indication that the application contains allowable subject matter, and that Claims 2, 6 to 9, 12, 13, 15 and 18 are allowable over the prior art of record.

In formal matters, the specification has been amended as to matters of form, including English spelling, grammar, idiom, syntax and the like. No new matter has been added.

By separate paper filed concurrently herewith, Applicants have filed a Request for Approval to Amend the Drawings. In the Request, Applicants have proposed formal amendments to Figure 11, as suggested by the Examiner. No new matter has been added.

The formal rejection of the claims respectfully is traversed. Nevertheless, without conceding the propriety of the rejections Claims 1 to 4 and 14 to 18 have been amended herein more clearly to recite various novel features of the present invention, with particular attention to the Examiner's comments. Support for the proposed amendments may be found in the original application. No new matter has been added.

The rejections of the claims over the cited art respectfully are traversed. The present invention relates to a novel vibration type actuator. In one aspect, as now recited in independent Claim 1, the actuator comprises an elastic member having a hollow

central portion formed along an axial direction thereof, and a driving portion in which driving vibration is generated, a fastening member, located on an inner periphery portion of the elastic member, which fastens the elastic member to an electro-mechanical energy conversion element, an output shaft which penetrates the hollow-central portion of the elastic member, a moving member in press contact with the driving portion of the elastic member, and which rotates together with the output shaft, and a bearing member located between the elastic member and the fastening member, and which journals the output shaft.

In a similar aspect, as now recited in independent Claim 14, the present invention relates to a vibration type actuator comprising a plurality of elastic members each having a hollow central portion formed along an axial direction thereof, and a driving portion in which driving vibration is generated. The actuator further comprises an electro-mechanical energy conversion element interposed between the plurality of elastic members, a fastening member having a hollow central portion formed along an axial direction thereof, said fastening member being located on an inner periphery portion of the plurality of elastic members and fastening the plurality of elastic members to the electro-mechanical energy conversion element, an output shaft which penetrates the central portions of the plurality of elastic members and which is restrained from slipping off outward in an axial direction, a plurality of moving members respectively in press contact with the driving portions of the plurality of elastic members, and which rotate together with the output shaft, and at least one bearing member respectively located between one of the plurality of elastic members and a respective end portion of the fastening member, and which journals the output shaft.

Applicants submit that the prior art fails to anticipate the present invention. Moreover, Applicants submit that there are differences between the subject matter sought to be patented and the prior art, such that the subject matter taken as a whole would not have been obvious to one of ordinary skill in the art at the time the invention was made.

The JP '170 reference relates to an ultrasonic wave motor, and discloses an ultrasonic wave motor which applies a three-phase AC voltage to three-sector electrodes sandwiched between two ring piezoelectric elements. The JP '170 reference further discloses a vibration type actuator in which a fastening member is located on an inner periphery portion of an elastic member. However, Applicants submit that the JP '170 reference fails to disclose or suggest at least the above-described features of the present invention. Rather, the JP '170 reference discloses a bearing for supporting an output shaft, where the bearing is located within or on an inner portion of the fastening member. That is, in the JP '170 reference, the fastening member is located between the bearing member and the elastic member.

For the above reasons, Applicants submit that independent Claims 1 and 14 are allowable over the cited art.

Claims 2 to 13 and 15 to 18 depend from Claims 1 and 14, respectively, and are believed allowable for the same reasons. Moreover, each of these dependent claims recites additional features in combination with the features of independent Claims 1 and 14, and is believed allowable in its own right. Individual consideration of the dependent claims respectfully is requested.

Applicants believe that the present Amendment is responsive to each of the points raised by the Examiner in the Official Action, and submit that the application is in

allowable form. Favorable consideration of the claims and passage to issue of the present application at the Examiner's earliest convenience earnestly are solicited.

Applicants' undersigned attorney may be reached in our Washington, D.C. office by telephone at (202) 530-1010. All correspondence should continue to be directed to our below listed address.

Respectfully submitted,

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VERSION WITH MARKS TO SHOW CHANGES MADE TO CLAIMS

1. (Amended) A vibration type actuator comprising:

an elastic member having a [in which a shaft center portion is formed in] hollow central portion formed [shape] along an axial direction thereof, and a driving portion in which driving vibration is generated [in a driving portion];

a fastening member located on an inner periphery portion of said elastic member, which fastens said elastic member to an electro-mechanical energy conversion element;

an output shaft which penetrates the hollow central [shaft center] portion of said elastic member;

a moving member [which is kept] in press contact with the driving portion of said elastic member, and which rotates together with said output shaft; and

a bearing member [which is] located between [on an inner periphery portion of] said elastic [bearing] member and [near a distal end portion of] said fastening member and which journals said output shaft.

2. (Amended) A vibration type actuator according to Claim 1, wherein said bearing member has one surface facing [the distal end portion of] said fastening member and another surface opposite thereto facing said elastic member.

3. (Amended) A vibration type actuator according to Claim 1, wherein said bearing member can move by a fixed distance along the [said] axial direction.

4. (Amended) A vibration type actuator according to Claim 1, wherein [said elastic member has a clearance in which] said bearing member [portion] can move in the axial direction between said elastic member and [, near the distal end portion of] said fastening member.

14. (Amended) A vibration type actuator comprising:

a plurality of elastic members [in] each having a [of which a shaft center portion is formed in] hollow central portion formed [shape] along an axial direction thereof, and a driving portion in [each of] which driving vibration is generated [in a driving portion];

an electro-mechanical energy conversion element [which is] interposed between said plurality of elastic members;

a fastening member having a [in which a shaft center portion is formed in] hollow central portion formed [shape] along an axial direction [and] thereof, said fastening member being located on an inner periphery portion of said plurality of elastic members and fastening [which fastens] said plurality of elastic members to said electro-mechanical energy conversion element;

an output shaft which penetrates the central [shaft center] portions of said plurality of elastic members and which is restrained from slipping off outward in an axial direction;

a plurality of moving members, respectively [member which kept] in press contact with the driving portions [portion] of said plurality of elastic members and which rotate [rotates] together with said output shaft; and

at least one [a] bearing member respectively [portion which is] located between one [on an inner periphery portion] of said plurality of elastic members and a respective [near a distal] end portion of said fastening member and which journals said output shaft.

15. (Amended) A vibration type actuator according to Claim 14, wherein said at least one bearing member [portion] has one surface facing [the distal end portion of] said fastening member and another surface opposite thereto facing one of said plurality of elastic members [member].

16. (Amended) A vibration type actuator according to Claim 14, wherein said at least one bearing member [portion] can move by a fixed distance along said axial direction.

17. (Amended) A vibration type actuator according to Claim 14, wherein [said elastic member has a clearance in which] said at least one bearing

member [portion] can move in the axial direction between one of said plurality of elastic members and [, near the distal end portion of] said fastening member.

18. (Amended) A vibration type actuator according to Claim 14, wherein a moving distance of said at least one bearing member [portion] in the [said] axial direction is restrained by an [the] inner periphery portion of one of said plurality of elastic members and [the distal end portion of] said fastening member.

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Application No. 09/864,265
Attorney Docket No. 03500.015389

VERSION WITH MARKS TO SHOW CHANGES MADE TO SPECIFICATION

Please substitute the paragraph starting at page 6, line 6 and ending at line 16, with the following replacement paragraph.

--Although the vibration member of the present embodiment is designed to provide the driving force by the composition of two bending vibrations, it may be one generating the circular or elliptic motion in the driving surface, for example, by composition of torsion and longitudinal vibration. An [The] effect equivalent to that of the present invention is also achieved as long as the vibration wave driving apparatus is of a type wherein a hole is present in the shaft center portion of the vibration member (hollow central portion) and the output shaft penetrates the hole.--

Please substitute the paragraph starting at page 8, line 10 and ending at line 13, with the following replacement paragraph.

--In the vibration member of the present embodiment, there are [is] few parts [part] capable of firmly supporting the vibration member. Therefore, a plurality of support means are provided.--

Please substitute the paragraph starting at page 11, line 2 and ending at line 14, with the following replacement paragraph.

--Each of the detent members 15, 16 is a member for transmitting the rotational force of the rotor 11, 12 being a rotating body, to the output shaft 2 and is press-fitted onto the output shaft 2 to be fixed in position. Of course, the detent members 15, 16 can be fixed to the output shaft 2 by a more secure [secure] method, such [like] laser welding. Further, it is also preferable to provide the outer peripheral surface of the output shaft 2 with knurls or spline grooves and press-fit the detent members onto the output shaft 2. A clearance is provided for adjustment of pressure or the like between the end portion of the rotating body and the detent member.--

Please substitute the paragraph starting at page 13, line 20 and ending at line 23, with the following replacement paragraph.

--Since the bearing is normally made of a material having a [with] generally high damping capacity of vibration, like polymer materials, the internal loss becomes large with deformation of the bearing due to the slipping.--

Please substitute the paragraph starting at page 16, line 21 and ending at page 17, line 2, with the following replacement paragraph.

--The present embodiment was described above as to a structure [the type] in which [the] rotors were placed on [the] both sides in the axial direction of the vibration member, but an [the] apparatus of the present invention also may [also] be of a type in

which only one rotor is placed on one side of the vibration member. Further, the present embodiment showed the arrangement of two bearings in the vibration member, but the apparatus may also be constructed with one bearing.--

Please substitute the paragraph starting at page 17, line 5 and ending at page 18, line 1, with the following replacement paragraph.

--Fig. 2 showed the structure wherein [the] three-step outer periphery portions were formed at [the] both ends of the hollow bolt 1, the male thread portion was formed in the center, outer periphery portion, the step between the center, periphery portion and the largest-diameter, outer periphery portion on the center side therefrom was made to contact the step formed in the inner periphery portion of the elastic member 6 to restrain further screwing, and the clearance was created between the bearing and the end of the hollow bolt 1; whereas the present embodiment provides a configuration in which a male thread portion is formed in the hollow bolt while leaving some length on the distal end sides. Then a butt portion 1c is provided as a distal end of the male thread portion of the hollow bolt 1 and the butt portion 1c comes to butt against a step portion formed in the inner periphery of the elastic member 6, thereby forming a clearance between the end 1a of the hollow bolt 1 and the bearing 8. In the embodiment shown in Fig. 2, however, a butt portion of the hollow bolt 1 on the other side (not shown) mostly butts against the cylinder bore portion of the elastic member 5 (which is not shown in Fig. 3 but shown in Fig. 1).--

Please substitute the paragraph starting at page 18, line 22 and ending at page 19, line 3, with the following replacement paragraph.

--The present embodiment is an example in which cylinder bore portions of a larger diameter are formed respectively at [the] both ends on the internal periphery of the hollow bolt 1 having a uniform, outside diameter and in which the bearings 8 are provided on the cylinder bore portions of the large diameter. The vibration member can be assembled readily by preliminary engaging the bearings 8 with the hollow bolt 1.--

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